

4 February 1992.

Dear Adam,

Herewith a copy of the paper we discussed last Saturday. covering something of the history of Glen Tanar forest.

It was presented at an Institute of Chartered Foresters conference in April 1990 called 'Silvicultural Systems'. Our paper was included in the section on 'Lessons from the Past'.

This is a spare copy there is no need to return it.

Yours
Irvine

MANAGEMENT AND SILVICULTURE OF THE FORESTS OF DEESIDE

by

HUGH G. MILLER

Department of Forestry, University of Aberdeen, Aberdeen
and

IRVINE ROSS

Glen Tanar Estate, Aboyne, Aberdeenshire.

Summary

The long history of utilization and management of pinewoods on Deeside is examined, with particular reference to Glen Tanar. The continued existence of these forests, especially after the removal of Royal patronage, owes much to the poor quality of the soil which meant that the produce of the forests, including summer grazing, was of more value than was that of the alternative agriculture. There is evidence for at least intermittent careful control of felling with implied acceptance of sustained yield, at least until the early part of the nineteenth century. However, although the requirements to achieve natural regeneration were understood (open space, sometimes with burning) there is no evidence that this knowledge ever modified the pattern of felling. The forests have survived largely by colonising areas recently burnt, felled or blown. Indeed, at Glen Tanar the forest has resulted in great measure from three major fires and one windblow. Only when deer populations were allowed to rise to high levels to satisfy sporting needs in the late nineteenth and

early twentieth century was regeneration effectively curtailed. It is concluded that the maintenance of these forests requires extensive areas of land and acceptance of fairly large blocks of quasi-even-aged stands separated by open areas.

The Region and its Forests

The north-east of Scotland has had a long history of forestry, centred predominantly on the valleys of the Dee and the Spey. To announce that one is a forester provokes no ribaldry, rather a discussion about a grandfather or great uncle who also boasted such a title. Further confirmation of the place of Deeside in forestry seems to be given by the old adage (which has various renditions):

"A foot of Don's worth two of Dee
Except it be for fish and tree"

(Sinclair, 1797).

Undoubtedly areas of upper Deeside have carried forests that have long been an important source of timber for local consumption and export. The fact that areas of ancient forest still exist, such as at Ballochbuie and at Glen Tanar, suggests that the pine, and perhaps even the birch and oak, must have been under some form of systematic sustained-yield management, however crude, for

centuries. Unfortunately, evidence to support this supposition, and details of such management as may have been carried out, are very difficult to obtain.

The forests of Deeside would have been oak on the more fertile river terraces and in the lower valley, pine (Pinus sylvestris L) dominated the dry gravelly sites whilst in the more fertile upper reaches and side valleys birch (Betula pendula Roth. or B. pubescens Ehrh.) alternated with pine and open moor, there being a mosaic in space and time as one succeeded the other. This succession would have been much modified by fire and windblow and in some areas one or other genus appears to have remained fairly dominant for long periods. Thus, records of the Forest of Birse suggest a mixed forest in which pine was only a component and in which birch was frequently dominant (Macgillivray 1855, Anderson 1967). By contrast, the records for Glen Tanar, going back as far as 1654 (Sir Robert Gordon of Straloch, quoted by Diack, undated), consistently refer to a pine forest;...."its banks (Water of Tanar) are crowned with huge forests of lofty fir trees" (ibid)"the Wood of Glentinar is very large tho' not full in all places. The timber of this wood, which is all fir, grows to a great height and bigness." (Spalding Club, 1725) "This forest produces Scotch fir (a species of pine) of a very good quality, which grows on the sides of the hills" (Sinclair 1797). In 1855 McGillivray, Professor of Natural History at Aberdeen, records that there was

still "a great extent of wood" but as a result of felling the large trees he hoped to see were absent, rather the forest consisted of "hundreds of stems not a foot in diameter, intermixed with others varying from that to three feet."

Because of the availability of records to the present authors much of what follows will concentrate on the history and management of Glen Tanar, but it is hoped to be able to place this in the context of upper Deeside as a whole.

Settlement within the Forest

The valley of the Dee was first settled to any great extent during the late bronze age. Place names attest to a long period of Celtic influence, although Gaelic ceased to be the main language of the area before 1400 (Darwin 1980). Darwin (1980) discusses various theories for the gaelic origin of the name Glen Tanar, including phrases meaning shallow stream, narrow glen, valley of the noisy stream and, perhaps most interesting (but with no reason to believe more correct than the others), a compound of the words Glean-an-Tanar, meaning the glen of scanty arable land. This idea is of interest because it does seem that continuance of the forest at Glen Tanar owes much to the very low occurrence of even the very poorest grade agricultural soil. This is in contrast to the position in the somewhat more fertile neighbouring glen

of the Forest of Birse where the extensive birch forests provided sufficient quality grazing to encourage the landowner, by a bit of legal trickery, to dispossess the commoners, who had grazing rights, and lease the land for permanent agriculture, with consequent loss of the forest cover.

As the doggeral recorded earlier implies, middle and upper Deeside was not good agricultural land. Sinclair (1797) observed "Deeside needs a shower every 24 hours, from May to August. And in very dry seasons, from the quantity and thinness of the soil, this district is very deficient in both corn and straw." Even yet spring droughts severely depress tree growth (Miller et al. 1979). Within Deeside as a whole, Glen Tanar is particularly disadvantaged for no outcrops of limestone occur, as are found, for example, in the main Dee valley. The Geology is entirely granite and schist, and except along the north-west edge of the glen the till has not been noticeably enriched by any other rock type. Furthermore, the Glen is predominantly of northern aspect. Its value for agriculture was, and is, minimal, although there has been a long history of grazing in the forest. Sheilings (huts used by herdsmen during summer grazing) were present in the 16th century (Diack, undated), probably largely for cattle, although the forest has also had a long history of goat rearing (at its peak in the 18th century when goat milk became fashionable as a health cure) and sheep were being grazed

in the 18th century eventually replacing the goats by 1850 (Diack, undated, Glentamar and Young 1948, Darwin 1980). However, it is known that the sheep were herded within the forest, being returned to the folds at night. An early practice of using the forest grazing in summer to fatten imported animals was voluntarily controlled in 1766 when 42 tenants of Glen Tanar, Glen Muick and the Forest of Birse entered into a commitment not to graze more animals than they could over-winter and not to build any more sheilings within the bounds of the forest (Diack, undated).

Forest Exploitation

With such poor agricultural potential it is inevitable that the owner and inhabitants of the glen looked to the forest for a source of income. In the publication of the Spalding Club (1725) the parish of Glen Tanar is said to be "mountainous, not very fertile, the people living more by trafficking in timber than husbandry". There are numerous records (e.g. Diack, undated) of local use, e.g. "it was..... the practice for the tenants and people of the district to purchase in the forest or birch woods what trees they wanted and manufacture them into saleable articles of all kinds". In a court case of 1710 referring to the Glen Tanar estate it is mentioned that it was the custom that the forest "furnish timber to the tenants for the upholding of their houses" and that "the Earl is obliged to furnish them". The same case,

however, makes it plain that the forest was serving more than a domestic market. "It is certain that the tenants will buy and sell all the timber can be yearly spared, ... which is just, because there are many tenants who make most of their rents by buying and working timber" (Diack, undated). In addition, the forest had to supply "the Earl of Aboyne's own markets and timbermen". The extent of the trade in timber on Deeside was such that in 1663, "diverse ministers" expressed concern at the great profanation of the Lord's day by timbermen ("traillers of timber") conveying their cargoes to the markets; the problem apparently not only being of concern "within the precinct of Kincardine" (i.e. Deeside) but also "from Abernethie within the Diocese of Moray" (Exercise of Alford 1663 in Diack, undated). Ultimately the Bishops and Synod applied to the "Lords of the Secret Council" to have certain timber markets changed from Monday to a more convenient day of the week.

The forest was long an important source of income for the owner. Diack (undated) suggested that the total proceeds of sales from the forest around the year 1700 was about 5000 merks Scots annually (ca. £227 Sterling) and in the Old Statistical Account Sinclair (1797) suggested that the forest brought Lord Aboyne £400-500 yearly. This timber was initially transported by dragging ("trailing") but ultimately floating down the Tanar and the Dee became the usual practice, until prevented by placing upon the

floaters liability for damage caused to banks and bridges.

At various times the Earls of Aboyne attempted to increase the rate of sale or to sell the felling rights to middlemen. In 1693 the timber rights were let to two tacksmen (lessees) but apparantly the lease was taken back within ten years (Diack, undated). In 1732 the Countess of Aboyne agreed to the construction of a sawmill equipped with "two sawes or blades". In 1744 the Earl sold "the whole fir trees, young and old, great and small" in a portion of the forest to a middleman, payment to be made over five years. However, the Jacobite rebellion of 1745 appears to have prevented this contract coming into operation. In 1809 the sale of 8000 trees from Glentamar was advertised in the London Times. In the same year the Earl of Fife announced the sale of 16000-20000 trees from the forest of Mar, further up the Dee valley, and similar announcements, albeit of smaller lots, were made in 1811, 1813 and 1814 (Anderson 1967). Most announcements boasted of the large size of the timber, with trees averaging over 15 m in length and 2 m^3 in volume, and of the ease of floating down the Dee to Aberdeen. Diack records that by 1809 the woodmen in Glen Tanar occupied a village of 50 huts and that during the 25 years occupancy of this hamlet about 150 children were born there.

By 1840 there must have been little saleable timber left in the forest for the Earl of Aboyne went bankrupt. McGillvray described the forest of 1843 as being disappointingly low in large trees, although there was a dense forest of trees of less than 30 cm diameter. In 1865 the Earl of Aboyne, having no timber of any value left, sold the estate to an Englishman who wanted a fashionable highland sporting estate similar to Balmoral. In 1870 a deer fence was constructed to keep red deer in the forest and all regeneration ceased until 1935.

Management

By the middle of the eighteenth century owners of forests in Deeside were already taking steps to mine their forests, a process that was to become dominant in the first half of the nineteenth century. How was it that forests had survived even this long on upper Deeside whereas the thrust elsewhere, even in neighbouring Donside, had been for conversion to agriculture? As already indicated, the absence of other sources of income from such infertile soils had encouraged both landowners and tenants to value the forest. There is undoubtedly an element of speculation in claiming that the value placed on the forest in the seventeenth and early eighteenth centuries (and by implication earlier) may have led to a form of sustained yield management. Yet there is some evidence to encourage this view.

For a long time, and at least as far back as the mid-seventeenth century, there had been the practice of organising the sale of timber, to tenants as well as outsiders, in lots called 'prysings' to which values were attached, under oath, by birleymen (birleymen, birliemen or byrlawmen, an arbiter or umpire in a sort of popular jurisprudence in Scottish rural areas concerning local disputations). Thus in 1710 "William Todd in Little Tullich and William Duncan in Bellandory, birliemen chosen within the lordship of Aboyne and sworn to be faithful and through the park of Diecastle and took inspection thereof and did appretiate the woods growing therein to the saum of 600 marks, being thirty apprizinges at twenty marks each pryzing" (Diack, undated). When the Forest of Glen Tanar was let to two tacksmen in 1693 the tack included the words "£5:16/- spent at compting the Forest of Glentanar, with £5:6:8 at compting the said forrest a second time, being cheated by some of those that were compters at first...."

In 1694 a group of five "apprisers" valued one portion of the woods while another group of four, including the William Todd mentioned as a birleyman above, appraised a remaining section. The first group declared that "the saids woods are not 10 merks worse at this time nor the same was at the last appretiatione in the year 'Nintie one years, and the reason ... is because of the growth of the wood and finds that the forester had done his duete" ... The second group found their woods "improven

since the last appretiatione be the growth of the saids woods to the value of what this appretiatone exceeds the last moir". The woods valued by the first group had increased in value by a mere 10 merks (1 merk = 13s 4d Scots = 1s 1 d Sterling) over the three years and this was a matter of congratulation. Could it be that the forester was being applauded on ensuring that felling was on a sustained yield basis?

There were foresters employed in Glen Tanar at least as early as 1685, when the payment was 20 marks Scots yearly. Diack (undated) described the duties of the forester thus: "the office of forester was in those days no sinecure. Besides giving general supervision, he was kept busy arranging for the constant stream of purchases, as existing accounts-books show, and taking instructions from the landlord". He suggests that Lord Aboyne usually had three foresters one of whom was based in Glen Tanar itself. In so far as the incumbent in 1707 is referred to as Patrick Gordon, tenant of Bordland, the forester may also have worked a croft. An earlier forester, one Robert Midlton, was also in Bordland in 1685.

That foresters were employed to control felling and sales is clear. Other than the congratulations after the appraisal referred to above the evidence for their role in managing the growing stock is not so clear. A most revealing document, however, is dated 1710. The Earl of Aboyne of the time was a minor and his estate was

administered for him by his tutor, the Hon. George Gordon, although the cautioner for his administer was the Duke of Gordon. The Earl's mother took exception to the performance of George Gordon, in particular "the havoc that is being made in the forest", and complained to the Duke. The resulting case before the Court of Session was resolved by accepting a scheme offered by an advocate, one Mr. Patrick Leith. Essentially, the parties had to nominate an agreed factor who would regulate felling and disposals along certain lines. These included, as first requirement, an annual marking by two honest and independent appretiators of the annual cut. The marked trees would be inventoried into birch and three sizes classes of pine and a value attached to each. The traditional needs of tennants should be met first, two birliemen being charged with ensuring that the claims were genuine. Sales should be standing, although the estate would subsequently supply "a number of good axmen", and there should be a unique marking axe which one John Ross was charged with keeping carefully. Oak and birch should be cut "sloping a hand breadth from the north towards the south with the mouth of the axe upwards to prevent rain from standing upon and rotting the old stock". The foresters were charged with keeping a proper record of the quantity of timber sold and price obtained.

Thus, there is at least some evidence of regular, if crude, inventories, valuations or stock-counts. There was also detailed record keeping and accounts in relation

to timber sales. Evidence of management for regeneration, however, is much more limited. As the quote above indicates, the need to fell oak and birch in such a way as to preserve an effective coppice stool was appreciated. Evidence of an understanding of the requirements for regeneration of pine comes from a different, and rather intriguing source. In 1758 Lord Braco (Michie, 1901), who was to become the Earl of Fife, took James Farquharson of Invercauld to court to prevent him allowing a crofter to cultivate a patch of soil in Allanquoich woods, adjacent to the current pinewoods of Ballochbuie. The persuer, Braco, had previously sold the estate to Farquharson but had retained the "right to the whole fir woods of natural growth growing or to grow on any part of the Earldom of Mar belonging to the Defender and the cut and dispose thereof....". This right, he argued, required that the new owner both preserve existing regeneration and avoid cultivating ground on which regeneration might occur for "it is inherent in the Nature of these Fir-woods gradually to shift their Stations". This was because "Fir-woods do not spring from the Root, but are propagated by the blowing of the Seed in the Grounds, immediately adjacent to the old Woods, or in Openings where they have freedom of Air, and these highland Fir-woods are not fixed to a particular spot, but gradually shift their stances; and, it was plainly for this Reason, that, in the original Feu-charters, not only the woods then growing, but to grow, were specially reserved; and the Nature of Things speaks

it, that this was absolutely necessary to attain the end proposed, because, if the spreading of the Wood, could be impune stopped in those Parts, where it naturally expands itself, its Existence would be of short Duration". Later it is recorded that the disputed area of some three acres carried "above 12000 young thriving Trees, from one to three Yards high, before they were destroyed by this Cottar, under Pretence of Cultivation". Clearly where there was "freedom of air" regeneration was sufficient.

In the same case we get some indication of the effect of stock grazing..." the trees upon that Moor run very little risk from the Cattle, as there is hardly any Pasture on the Moor adjacent to the Woods, and the cattle are all grazed in the Forests, where there is the best Out-pasture...". Again, as already mentioned, the farmers at Glen Tanar were persuaded in 1766 to agree only to graze in the woods in summer that number of cattle they could overwinter, and to give up the previous system of buying in cattle to fatten in the woods. Furthermore, it was agreed that any new sheilings had to be established outwith the bounds of the woods (Diack, undated). There seems to be no record of the goats at Glen Tanar needing special control although by analogy with the sheep it could be expected that they were herded and not left in the woods overnight. Red deer damage received no mention until the mid-nineteenth century. Could the level of human activity in the woods have kept the deer away? There certainly were deer locally for in

1719 Lord Aboyne gave instructions for a deer carcass to be sent to Edinburgh at a cost of £6 Scots, and Glen Tanar was reserved as a hunting forest for the king prior to passing to the Earl of Aboyne in 1446. Similarly, the Forest of Birse was a hunting forest for the Bishops of Aberdeen, presumably more for food than for sport.

Although there was knowledge of the requirements for regeneration, and the need to protect it, there is no indication of how the needs of regeneration influenced felling. Anderson (1967) suggests that the natural method of regeneration in Upper Deeside in the early eighteenth century was a kind of group selection seeding by large groups. There is tenuous evidence for selective felling of stems or small stands. Sinclair (1797) records that the axe-men of Glen Tanar were "particularly alert in picking out and cutting down the largest trees". In 1744 the Earl sold 302 of the largest and best trees "that could be chosen" out of a particular area of wood. In the same contract, however, was sold "the whole fir trees, young and old, great and small, presently grown on that part of Glentanar called the Haugh of Allachy" (Diack, undated). The age structures of the pine forests of Deeside, not only Glen Tanar, show no evidence of group felling. Rather, the even-aged nature of the stands suggest felling over moderate to extensive areas or, as will be discussed, the intervention of catastrophe.

It is clear that the entire forest area was never fully stocked ("the wood is very large tho' not full in all places"; Spalding Club, 1725). The clear fell at the Haugh of Allachy, referred to above, was said to yield 6698 fir trees. From the description in the contract the area yielding these trees can be measured from which it is computed that the average stocking of trees "great and small" was only 39.4 spha. The current nature of the woods, and other accounts, would suggest that the sparse stocking is due to the amount of open space within the prescribed area rather than a low stocking density within particular stands. Thus Farquharson (quoted in Anderson, 1963) states "seedlings when young, rise extremely close together, this makes them grow straight, and free from side branches of any size, to the height of 50 or 60 feet before they acquire the diameter of a foot". An exception might be on the edge of the woods where even yet there are widely spaced large mother trees with regeneration developing around them. A fire in 1920 is recorded as having burnt 313 ha of stocked woodland with an average stocking of 248 spha and volume of $87 \text{ m}^3 \text{ ha}^{-1}$. Putting various accounts together suggests a pattern of well stocked stands separated by ample open areas wherein, if cattle grazing was kept down, regeneration occurred. There is nothing to suggest that felling was organised to promote regeneration.

Although the nineteenth century was characterised by large clear fells many parts of the forest predate this

time. If the regeneration of such areas came from small coupes a fairly intimate age mixture might be expected. This is not the case so suggesting extensive fellings, although to this has to be added is probably because of the intervention of fire.

The Role of Catastrophe

Major fires have been recorded in the forest of Glen Tanar about every fifty to sixty years. There are written records of damaging fires in 1688 ("large quantities" burnt), 1748 (5 km of forest burnt), 1810 (90-180 ha destroyed), 1820 (a "great area" burnt), 1920 (640 ha) and 1956 (110 ha). To these have to be added records of severe windblow in 1688, 1733 and 1953 (Diack, undated, Steven and Carlisle 1959, Darwin, 1980).

Of these fires those of 1820 (perhaps including some of the area burnt in 1810) and 1920 have clearly had a significant impact on the present structure of the forest. As shown in Figure 1 the forest falls broadly into three age classes, i.e. less than 45 years old, around 140-170 years old and 200-270 years old. Some of the younger age category dates, as shown in figure 2, to the 1953 gale, which was so destructive of forest in the North-east of Scotland, and the rest to expansion of the forest, along its western flank, onto areas regularly burnt for grouse management. The gamekeeper recalls moving the area to be burnt progressively further away

from the forest every year to avoid fire running through the natural regeneration and so into the main body of the forest. The regeneration success seems to be a consequence of the seedbed provided by the burning and the managed reduction of grazing pressure.

There are good records of the area burnt in 1820 (Figure 3) and clearly much regeneration dates back to the aftermath of this fire, although large tracts have been converted to grouse moor and remain unforested. There are no detailed maps of the 1820 fire but Diack (unpublished) records that it ran north from the head of the Gairney almost reaching the wood cutters village at the foot of the Strone. From the age structure and stocking of the present forest a presumed minimum area for this fire (minimum because of subsequent destruction) can be suggested (Figure 4). There remains the area along the Water of Tanar and the area of the old trees at the two southern extremities of the forest, the trees in the former area dating to the first part of the eighteenth century whereas the latter area contains the oldest trees aged 200-270 years (perhaps dating to the fire and windblow of 1688). It is probably no accident that the older areas of the forest are all upstream of waterfalls (see Fig 1) or other river sections that would seem unsuitable for log floating. Extraction from these areas must have been considered impracticable because had they been of value they would surely have been felled in 1840 to stem off the Earl of Aboyne's bankruptcy and the

subsequent need to sell the estate as sporting property in 1865.

The area below the waterfalls, the forest in which dates back to around 1820 to 1840, is probably that felled in the first quarter of this century when the timber village was occupied (Figure 1). The area is that over which extraction could be made to a river capable of floating logs of the size then available, hence its restriction in the upper reaches by the waterfalls.

Thus, the stands forming the forest of Glen Tanar dates to various catastrophic events, including the exploitive felling of the first part of the nineteenth century. The regeneration areas are large, the stands are quasi-even-aged and there is no evidence of deliberate management for regeneration, other than stock control.

Planting and the Modern Era

The first written reference to planting is as recent as 1920-30. No detailed records were kept until the appointment of Duncan Ross as forester in 1947. However, it has generally been assumed that much of the area felled in the second World War and subsequently was planted. The telling factor here is the presence of a small admixture of European larch in the Scots pine, once the standard mixture in Scotland. One of these stands is within the 1870 fence constructed to keep deer in the

forest, a step that led to the absence of natural regeneration for the next six decades. If planted trees were to survive within this fence they must have been of a size sufficient to avoid browsing damage. None of these crops exist today but two of the larch stumps have been located. One lacked a centre and the other had lost some sapwood but making a reasonable assumption in each case about the number of rings so obscured gave planting dates of the two trees of 1845 and 1853. Thus, it seems likely that planting was being carried out around 1850, which matches well with the known fashion for planting around this time elsewhere in North-east Scotland (e.g Anderson 1967). There still remain planted stands dating from 1870 and later, these having been planted during the period when the estate was owned by Brookes, who had a reputation as an improving landlord.

The forests of Deeside, including Glen Tanar, suffered considerable losses in both World Wars. During the Second World War the Canadian Forestry Corps felled at Glen Tanar 100,000 m³ from about 1000 ha of both natural and planted forest. With the appointment of Duncan Ross in 1947 a determined effort was started to repair the war time damage, including gradually thinning of areas of the old forest in preparation for eventual seeding fellings.

Lessons from the past

By the start of the nineteenth century the forest was thought of as simply a resource to be mined and old skills that had ensured continuance of the forest were lost. What these were we have only hints.

Perhaps the immediate, and unremarkable, message from the history of the Deeside pinewoods is that forests will only be maintained where the value of the produce from the forest is greater than that of the produce that the land could yield under agriculture. If attempts to test the agricultural potential of the land do not entail extensive clearing the forest will come back, provided that grazing is not excessive. Regeneration of the forest requires "openings where they have freedom of Air". Such openings can be found beyond the margins of the forest or within the forest following fire, windblow or clear felling. The areas so regenerated are extensive and as a result the pine woods "gradually shift their stances". From this it seems that the maintenance of such woods does entail setting aside extensive tracts of land of sufficient size to carry a viable, regenerating forest. Within such areas, however, regeneration should be easily attained provided there is the open space and grazing is tightly controlled, although not necessarily totally prevented. Preparation of a seedbed through burning, cultivation or trampling by controlled grazing may be advantageous but is by no means essential, except where a depth of moss and raw humus has built up.

The message seems encouraging for the future success of the New Native Pinewood Grant scheme, although there does seem to be a warning against trying to achieve elaborate structures giving small scale diversity. The woods, by nature, are extensive, quasi-even-aged and regenerate best in large blocks on open ground. Detailed preparation of such ground, however, is not usually required unless rapid early height growth is being sought.

REFERENCES

- Anderson, M L (1967). A History of Scottish Forestry, Vols 1 and 2. Thomas Nelson and Sons Ltd, London.
- Darwin, T (1980). Glen Tanar National Nature Reserve: Notes on the Land-use History of the Reserve Area (unpublished manuscript, NCC).
- Diack, F C (undated). A History of Glen Tanar (unpublished manuscript, Glen Tanar Estate).
- Glentanar and Young J (1948). Food production from hill pastures. Scottish Agriculture, 4.
- Macgillivray W (1855). The Natural History of Dee Side. and Braemar (ed E. Lankester) (Privately printed).
- Michie, J G (1901) (ed.). The Records of Invercauld, 1547-1828. New Spalding Club, Aberdeen.
- Miller, H G and Cooper, J M (1976). Tree growth and climatic cycles in the rain shadow of the Grampian Mountains. Nature 260, 697-698.
- Sinclair, J (1799). Old Statistical Account of Scotland.
- Spalding Club (1725). Antiquities of Aberdeen and Banff II, p 34.
- Steven, H M and Carlisle, A (1959). The Native Pinewoods

REFERENCES

- Anderson, M L (1967). A History of Scottish Forestry,
Vols 1 and 2. Thomas Nelson and Sons Ltd, London.
- Darwin, T (1980). Glen Tanar National Nature Reserve:
Notes on the Land-use History of the Reserve Area
(unpublished manuscript, NCC).
- Diack, F C (undated). A History of Glen Tanar
(unpublished manuscript, Glen Tanar Estate).
- Glentamar and Young J (1948). Food production from hill
pastures. Scottish Agriculture, 4.
- Macgillivray W (1855). The Natural History of Dee Side.
and Braemar (ed E. Lankester) (Privately printed).
- Michie, J G (1901) (ed.). The Records of Invercauld,
1547-1828. New Spalding Club, Aberdeen.
- Miller, H G and Cooper, J M (1976). Tree growth and
and climatic cycles in the rain shadow of the
Grampian Mountains. Nature 260, 697-698.
- Sinclair, J (1799). Old Statistical Account of Scotland.
- Spalding Club (1825). Antiquities of Aberdeen and Banff
- Steven, H M and Carlisle, A (1959). The Native Pinewoods
of Scotland. Oliver and Boyd, Edinburgh.

CAPTIONS TO FIGURES

Figure 1. Distribution of age classes in the Glen Tanar native pinewoods together with main watercourses, at the north-east corner the Water Tanar joins the River Dee. Absence of ages between 45 and 140 years reflects the period when red deer populating were maintained at a high level on the estate for sporting purposes. Also marked (w) are the waterfalls on the Water of Tanar and on the Water of Allachy (scale 1:50,000).

Figure 2. The Glen Tanar native pinewoods as shown in Fig. 1 with, superimposed, the area of managed (burnt) grousemoor dating to the immediate post-war years and the areas destroyed by the 1953 gale.

Figure 3. The Glen Tanar native pinewoods, as shown in Fig. 1, with, superimposed, the area destroyed by fire in 1920.

Figure 4. The Glen Tanar native pinewoods, as shown in Fig. 1, with, superimposed, the estimated minimum area destroyed by the 1820 fire. Also shown in cross-hatching at the junction of the Water of Tanar and Water of Allotchy is the location of the woodcutters village of ca. 1809-1834.

KEY



0-45 YEARS



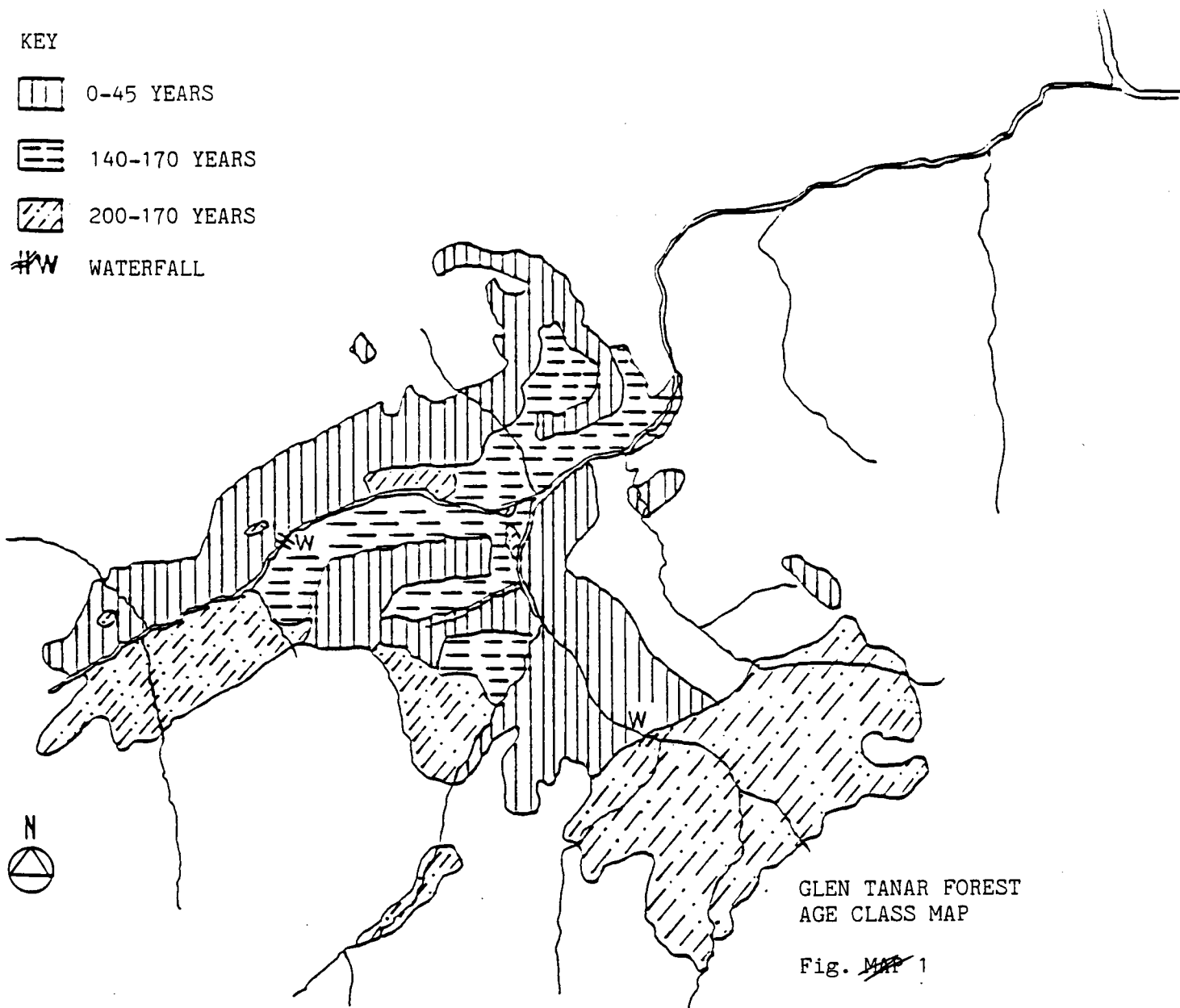
140-170 YEARS



200-170 YEARS



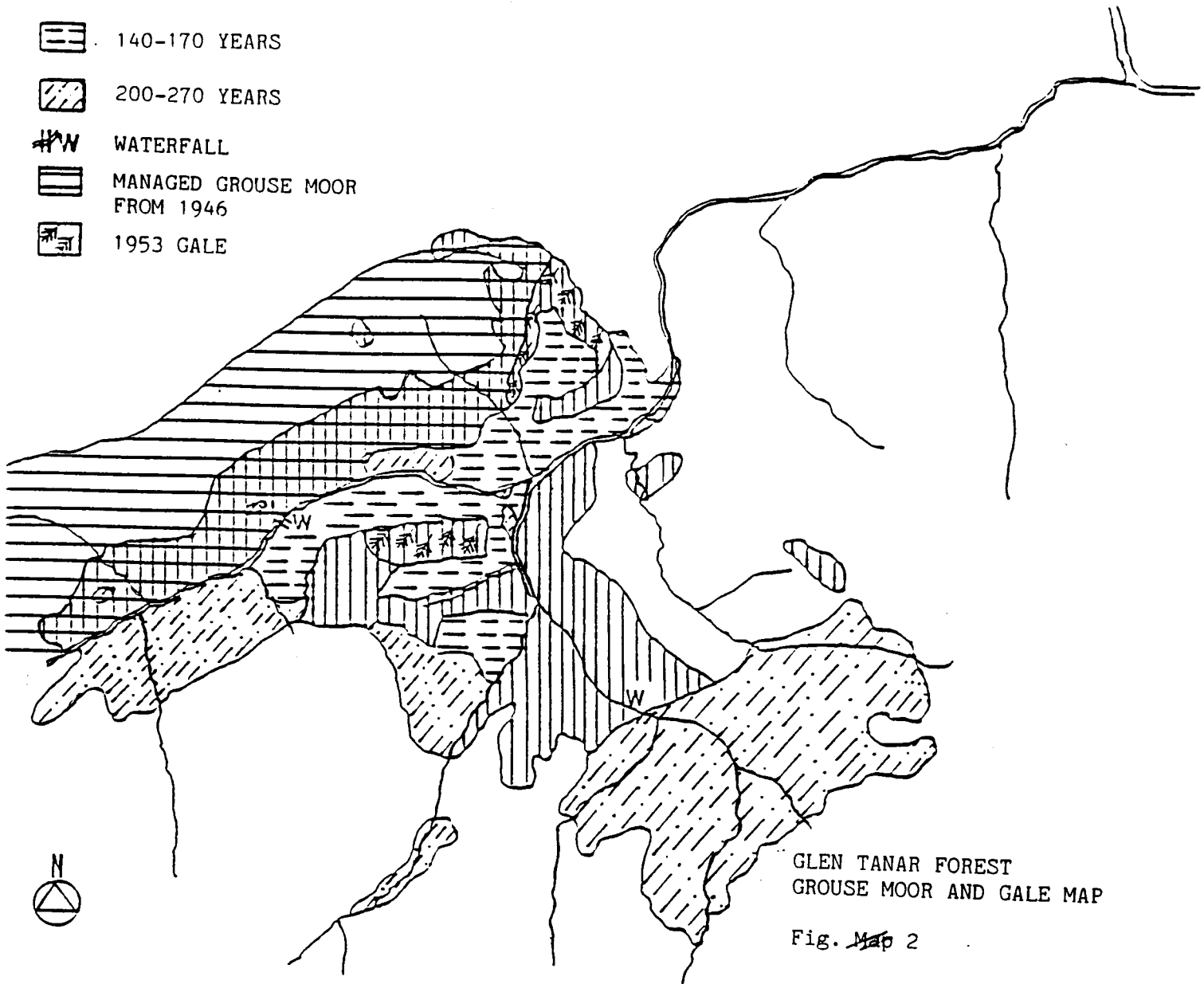
WATERFALL



GLEN TANAR FOREST
AGE CLASS MAP

Fig. ~~MAP~~ 1

-  0-45 YEARS
-  140-170 YEARS
-  200-270 YEARS
-  WATERFALL
-  MANAGED GROUSE MOOR
FROM 1946
-  1953 GALE



GLEN TANAR FOREST
GROUSE MOOR AND GALE MAP

Fig. ~~Map~~ 2

KEY



0-75 YEARS



140-170 YEARS



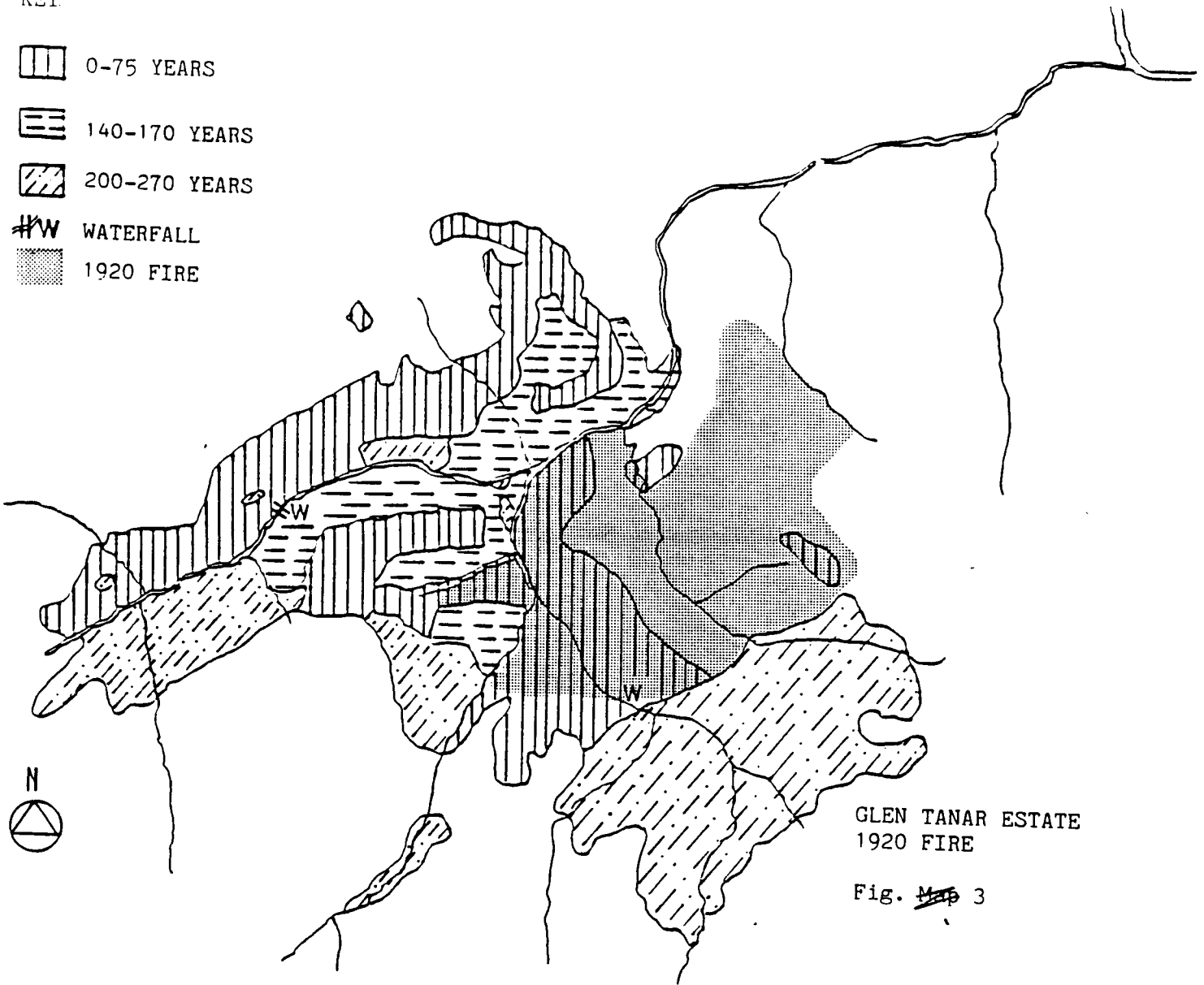
200-270 YEARS



WATERFALL



1920 FIRE



GLEN TANAR ESTATE
1920 FIRE

Fig. ~~Map~~ 3

KEY



0-45 YEARS



140-170 YEARS



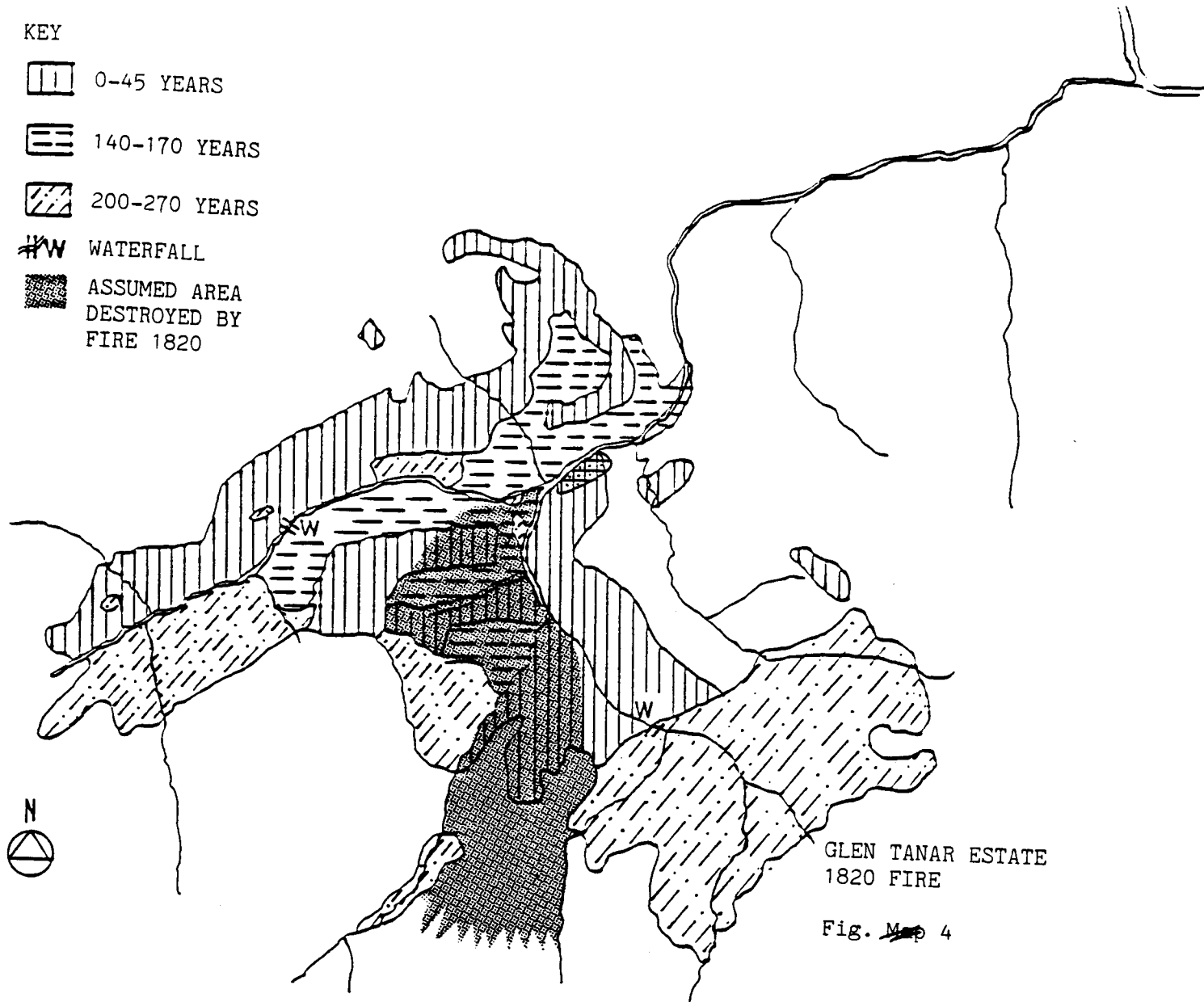
200-270 YEARS



WATERFALL



ASSUMED AREA
DESTROYED BY
FIRE 1820



GLEN TANAR ESTATE
1820 FIRE

Fig. Map 4